The Japan Cement Industry's Strategy for Carbon Neutrality by 2050 and Energy Conservation

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Topics

1. Overview of the current situation
2. Production process
3. Process Emissions and Energy Emissions
4. Our visions on a Carbon Neutrality in 2050
5. Technologies Roadmap
6. Energy conservation
7. Best Available Technology
8. Utilizing waste as AFRMs

Overview of the current situation (1)

(Next: continued to(2))

In FY2025

Companies : 15,　Plants : 27,　Kiln Capacity : 49,139,000 t/year

Location of plants

TAIHEIYO GROUP
①TAIHEIYO CEMENT
②MYOJO CEMENT
③TSURUGA CEMENT
④D･C

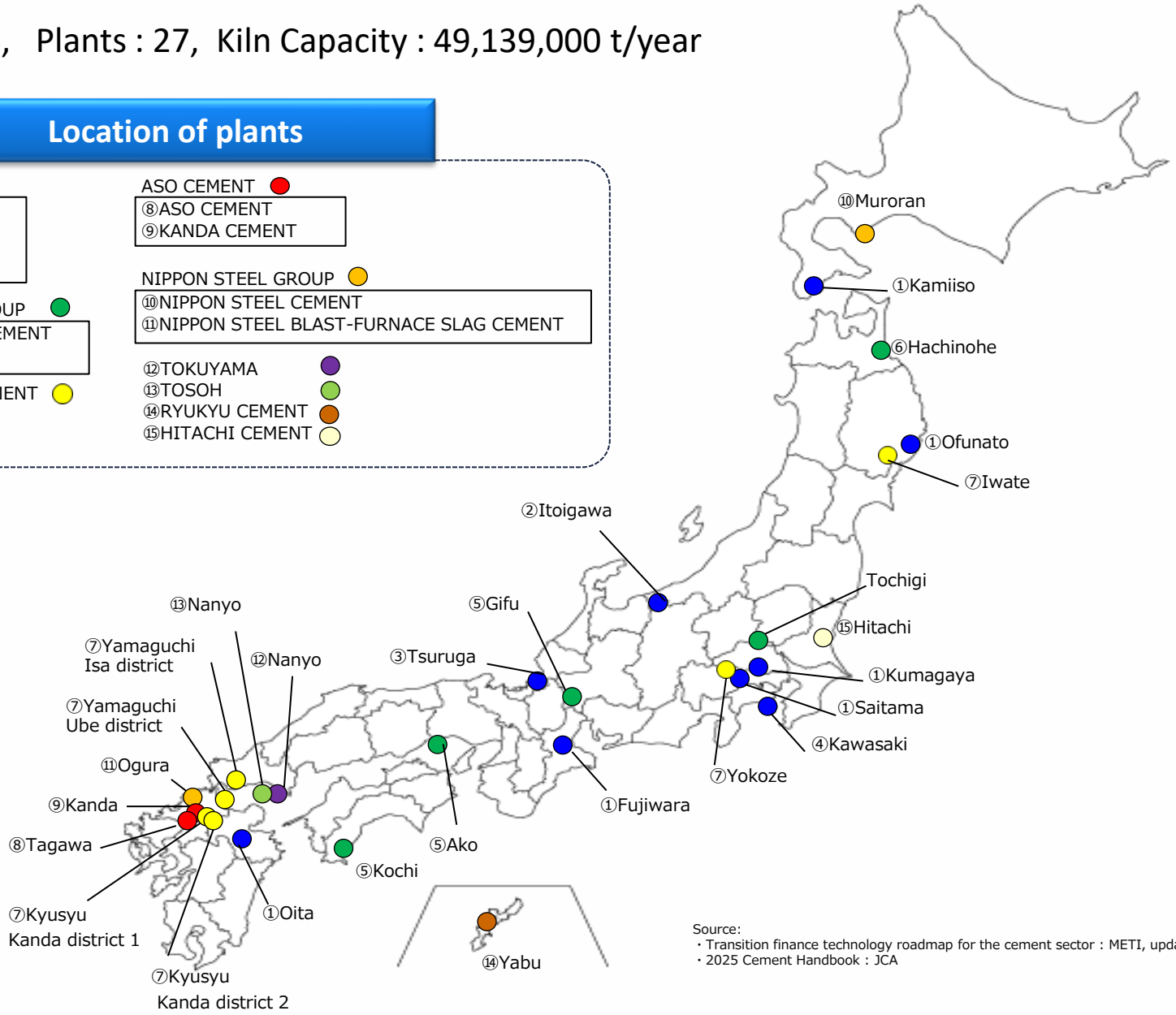
SUMITOMO OSAKA GROUP
⑤SUMITOMO OSAKA CEMENT
⑥HACHINOHE CEMENT

⑦UBE MITSUBISHI CEMENT

ASO CEMENT
⑧ASO CEMENT
⑨KANDA CEMENT

NIPPON STEEL GROUP
⑩NIPPON STEEL CEMENT
⑪NIPPON STEEL BLAST-FURNACE SLAG CEMENT

⑫TOKUYAMA
⑬TOSOH
⑭RYUKYU CEMENT
⑮HITACHI CEMENT

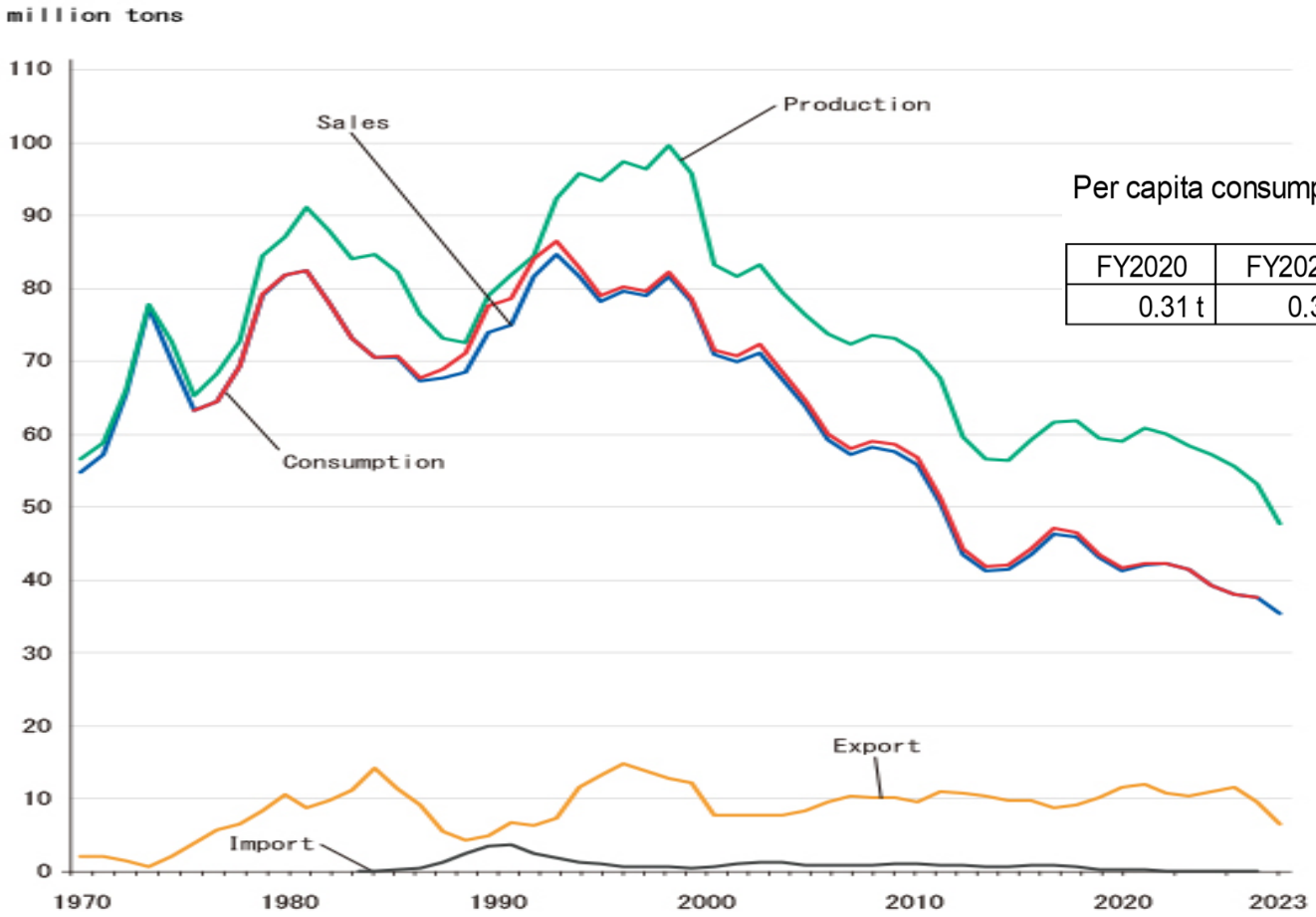


Source:
・Transition finance technology roadmap for the cement sector : METI, updated by JCA
・2025 Cement Handbook : JCA

Overview of the current situation (2)

(Next : Production process)

Current situation of demands



Per capita consumption

FY2020	FY2021	FY2022	FY2023	FY2024
0.31 t	0.30 t	0.30 t	0.28 t	0.27 t

Note:Cement production includes exported clinker from 1992.
Ecocement is included from 2006
Eccocement is a completely new and revolutionary type of cement made primarily from the incinerator ash of municipal waste.

Source: JCA English homepage
https://www.jcassoc.or.jp/cement/2eng/e_02a.html

Reasons for the recent decline

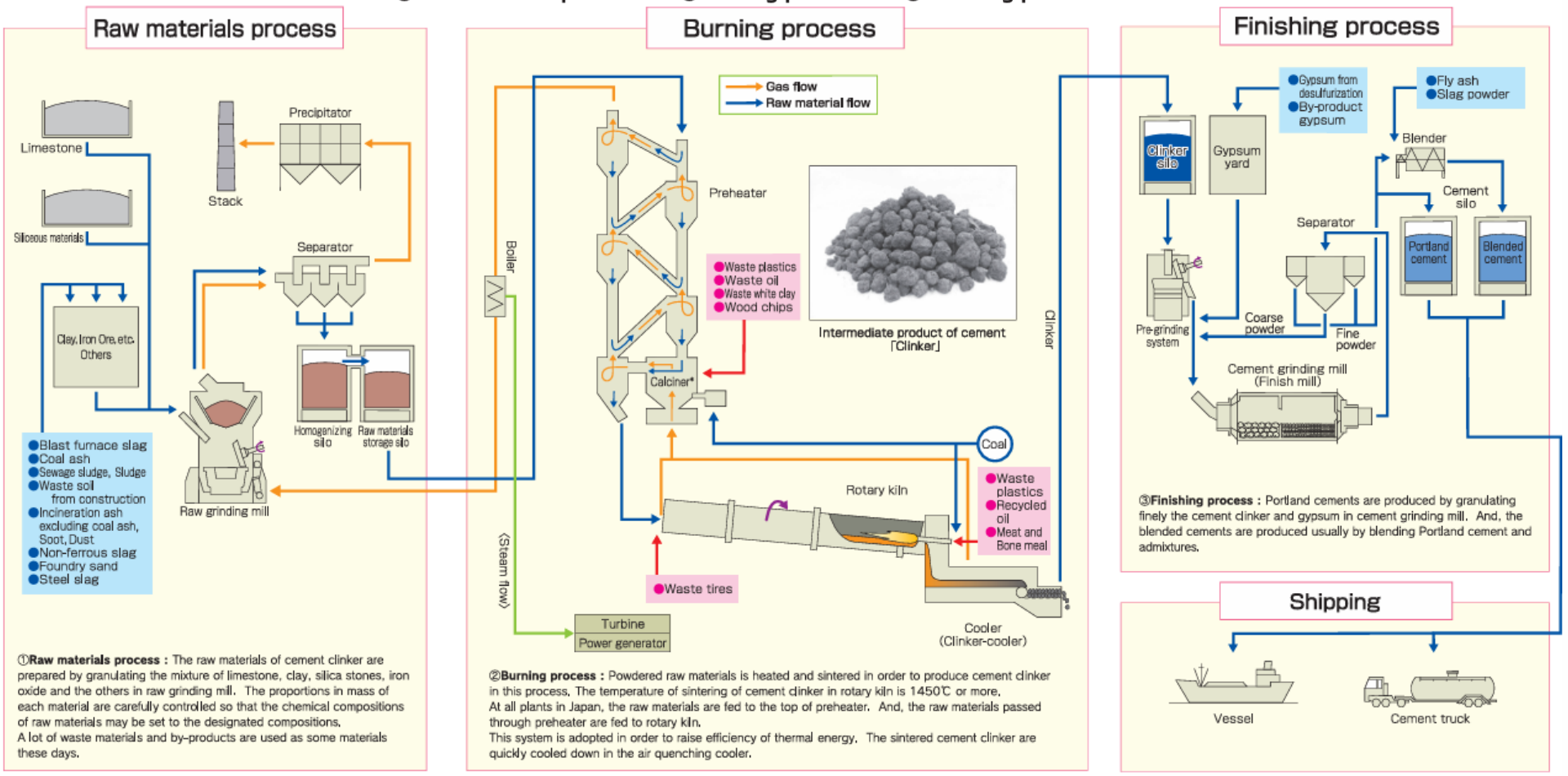
✓Labor shortages, ✓Work style reform, ✓Rising material costs, etc…

Production process

(Next : Process Emissions and Energy Emissions)

Manufacture of cement consists of the following three processes.

①Raw materials process　②Burning process　③Finishing process



Effective use of the thermal energy in manufacture of cement :

A lot of thermal energy is used in the cement plants. The orange line in the figure of burning process shows the flow of gas. The gases from rotary kiln and cooler are high temperature. When these gases are exhausted, the thermal energy of these gases is not used effectively. Then, the manufacturing processes of cement are designed to use the thermal energy of gases thoroughly. The gases from rotary kiln and cooler are led to the preheater. The thermal energy of these gases is used for the heating of raw materials including calcination of carbonate. And then, the gas from the preheter is led to the boiler (*) for generating steam of power generation. Finally, the gas from the boiler is led to the raw grinding mill at raw materials process, and the thermal energy of this gas is used for drying raw materials. Overall, the plant operates at over 80% thermal efficiency.

(*) The boiler may not be installed.

Above figure source: The Cement Industry in Japan 2024 (JCA), https://www.jcassoc.or.jp/cement/4pdf/jj3h_02_2024.pdf

Process Emissions and Energy Emissions

(Next : Our Visions on a Carbon Neutrality in 2050)

Process-related CO_2 emission
(Decarbonation of limestone)
※$CaCO_3 \Rightarrow CaO+CO_2$

60%

CO_2 Emissions

40%

Energy-related CO_2 emission
(Thermal energy for burning and Electricity)

*Featuring Process Emission

Amount of raw materials required to produce 1 ton of cement (Unit : kg)	
Limestone（CaCO3）	1,200
Clay	226
Silica	71
Iron	29
Gypsum	39
Total	**1,565**

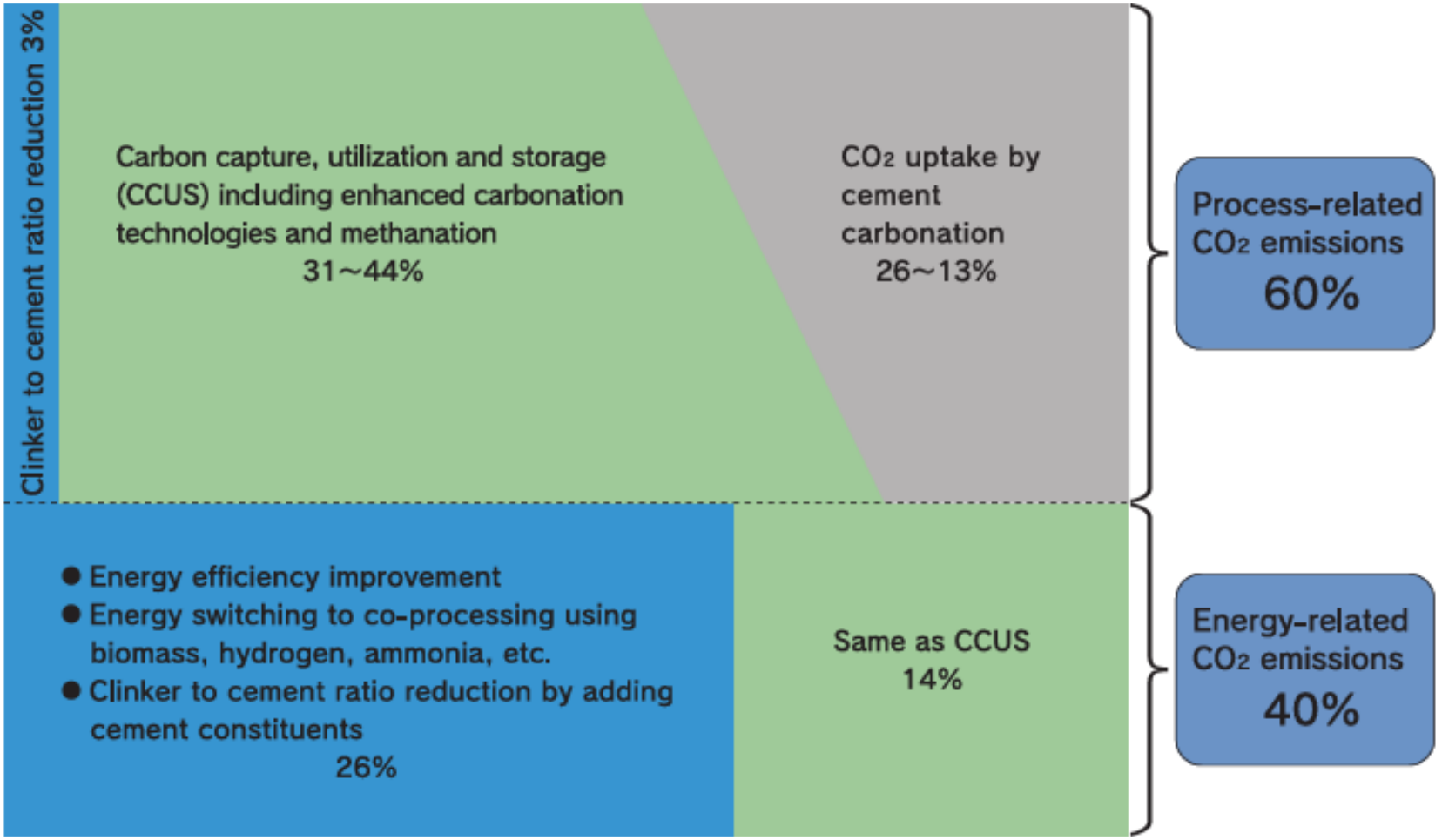
$$CaCO_3 \rightarrow CaO + CO_2$$
$$100 \qquad 56 \qquad 44$$

**When limestone is calcined,
nearly half of it is released as carbon dioxide (CO2).**

Source: Investigation by JCA

Our Visions on a Carbon Neutrality in 2050

(Next : Technologies Roadmap)

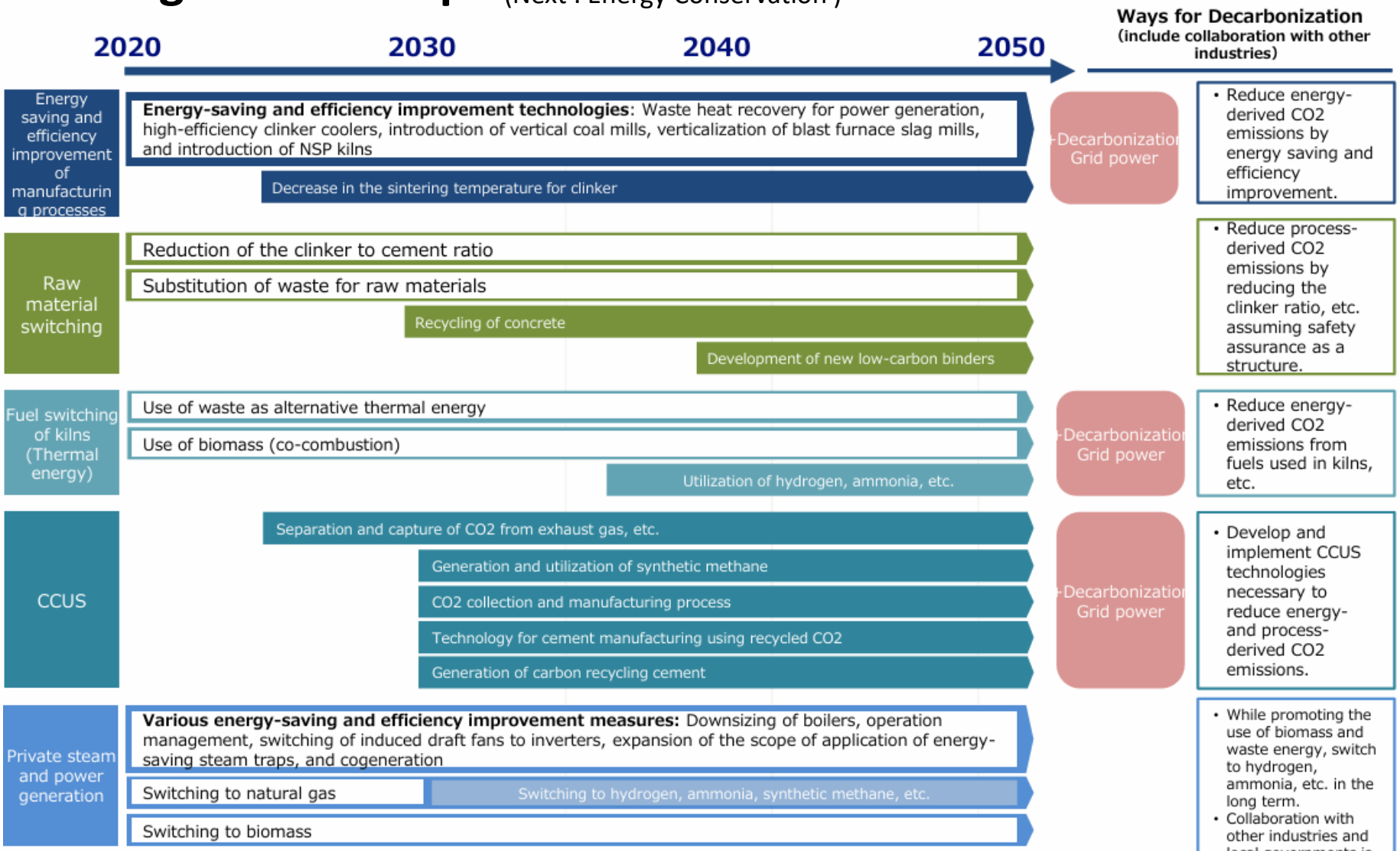


Note: A reduction ratio of process-related CO_2 emissions using CCUS is corresponded to an amount of CO_2 uptake by the cement carbonation using each estimation model.

Source : JCA English homepage, https://www.jcassoc.or.jp/cement/2eng/e_01d.html

Technologies Roadmap

(Next : Energy Conservation)



*In the cement industry, about 80% of energy consumption is heat energy.
*Regarding fuel switching, it is assumed that conversion to waste and biomass will proceed underway, followed by switching to natural gas and other fuels. In the future, switching to hydrogen, ammonia, etc. using pipelines laid for natural gas, etc. is also possible.

Source: Technology Roadmap for "Transition Finance" in Cement Sector by Ministry of Economy, Trade and Industry
https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_technology_roadmap_cement_eng.pdf

Energy Conservation (1)

(Next: continued to(2))

About Energy Conservation Act

What is the Energy Conservation Act of Japan?

This law requires businesses of a certain size or larger (using energy equivalent to 1,500 kl or more per year of crude oil) to regularly report on their energy usage, and to review and formulate plans for energy conservation and non-fossil fuel conversion.

Why is the act important in Japan?

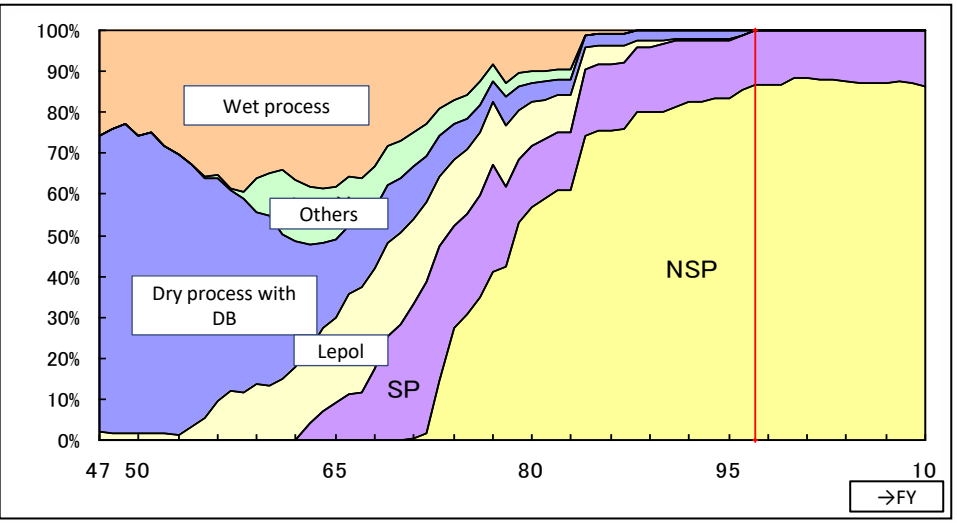
✓Japan is a resource-poor country, and its ability to create new things is lower than that of other countries.

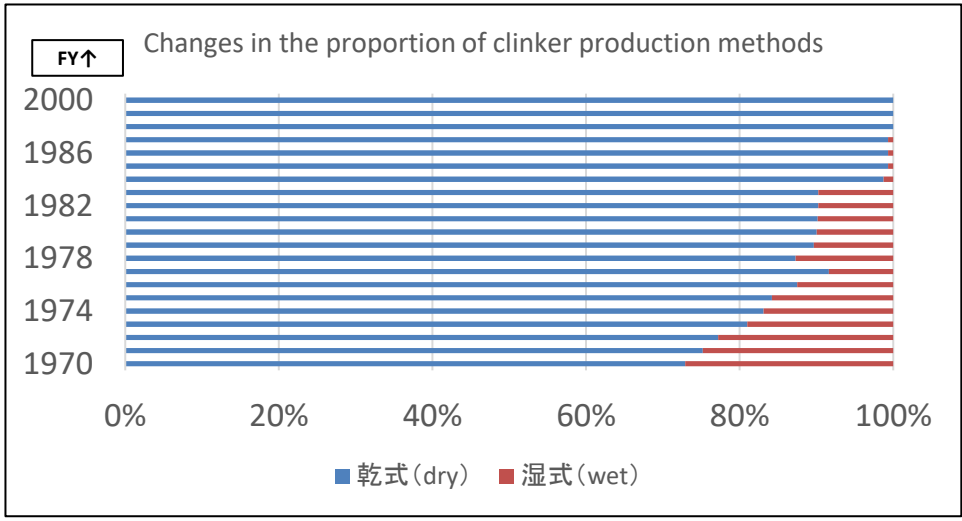
✓The law will streamline businesses' energy use, reduce costs and improving efficiency.

✓The obligation to conserve energy and switch to non-fossil fuels was established in 2023. This has important significance for CN.

In particular, Oil crisis prompted the enactment of this Energy Conservation Act in Japan.

Transition of cement manufacturing process in Japan



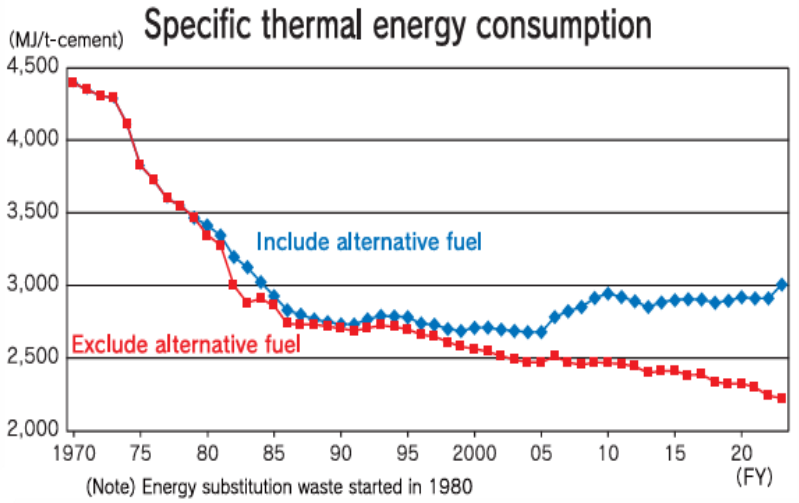


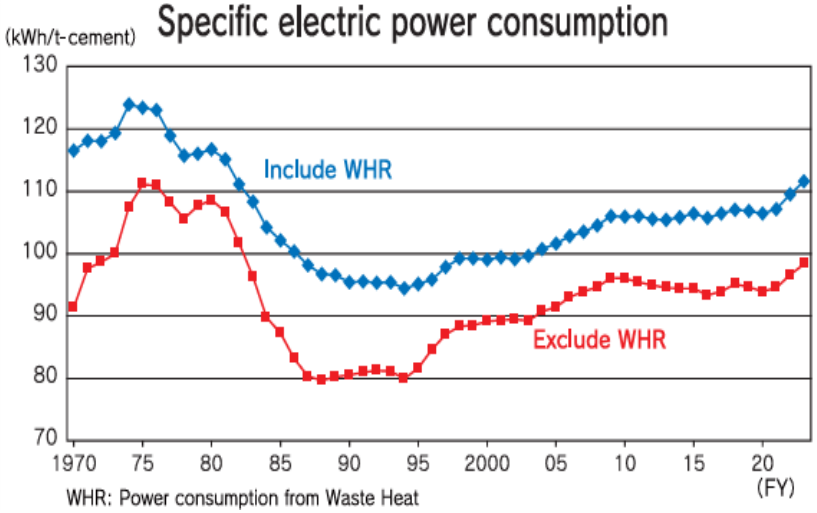
Source: Investigating by JCA

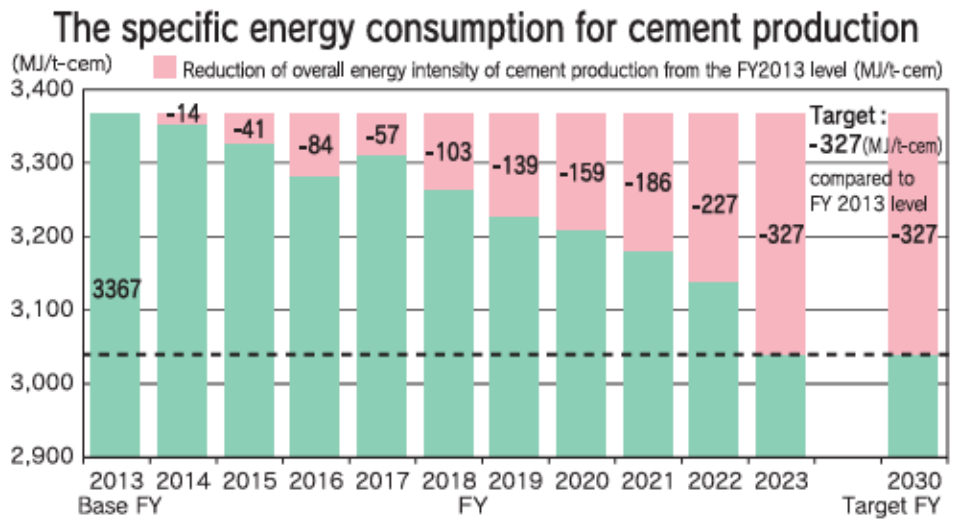
Energy Conservation (2)

(Next : Best Available Technology)

Energy conservation trends of the Japan cement industry







Figures sources: The Cement Industry in Japan 2024 (JCA)
https://www.jcassoc.or.jp/cement/4pdf/jj3h_02_2024.pdf

Best Available Technology

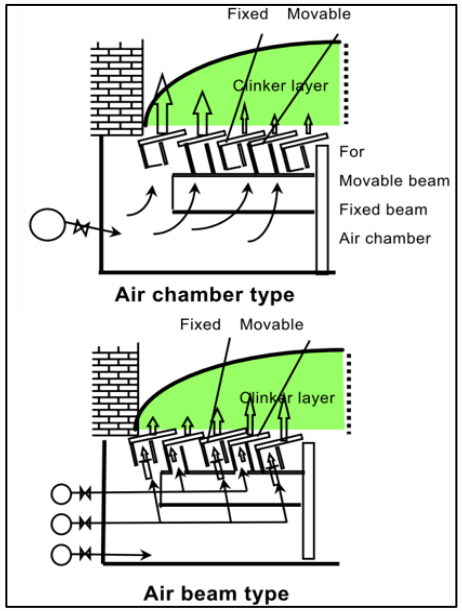
(Next : utilizing waste as AFRMs)

			capacity	compare			
				Before installation	After installation	efficiency	Reduction width
Raw material process	1	Vertical Roller Mill	t-RM/h	kWH/t-RM			%
			200	23	16	7	30
	2	Vertical coal grinding mill	t-coal/h	kWh/t-coal			%
			17	45	33	12	26
Burning process	3	NSP・SP	t-cli/d	MJ/t-cli			%
			3000	5668	3336	2332	41
	4	Suspension preheater 5-stage cyclone	t-cli/h	kcal/kg-cli			%
			150	750	730	20	3
	5	High-efficiency cooler	t-cli/h	kcal/kg-cli			%
			150	750	730	20	3
	6	Waste heat power generation	kW/1 million t plant	—			
			5000kWh				
Finishing process	7	Pre-crusher	t-cli,ce/h	kWH/t-cli,ce			%
			150	45	39	6	13
	8	High-efficiency separator for finishing mills	t-cli,ce/h	kWH/t-cli,ce			%
			150	45	43	2	4
Admixtures	9	Vertical slag mill	t-slag/Year	kWh/t-slag			%
			400,000	70	49	21	30
Burning process (preparation)	10	Transition from SP to NSP (3407→3336 MJ)		[MJ/t-cli]			%
				3,407	3,336	71	2

Source: Investigating by JCA

Ex. Vertical Roller Mill

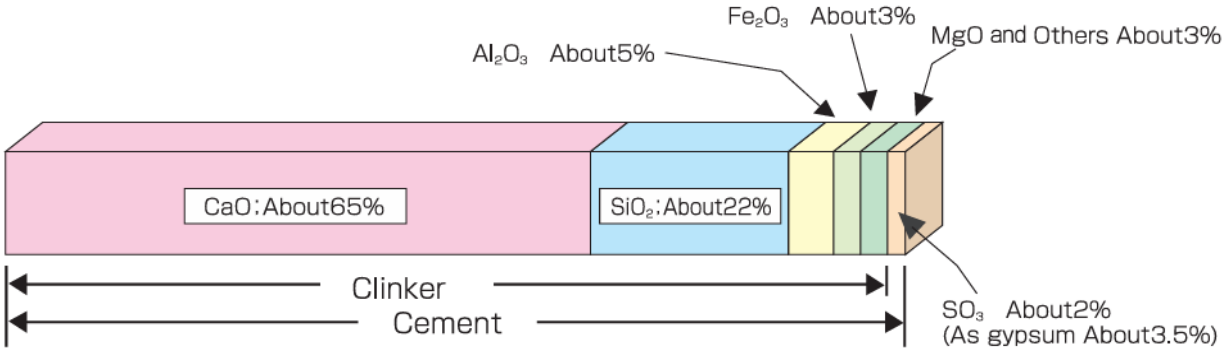
Ex. High-efficiency Cooler



Utilizing waste as AFRMs* (1)

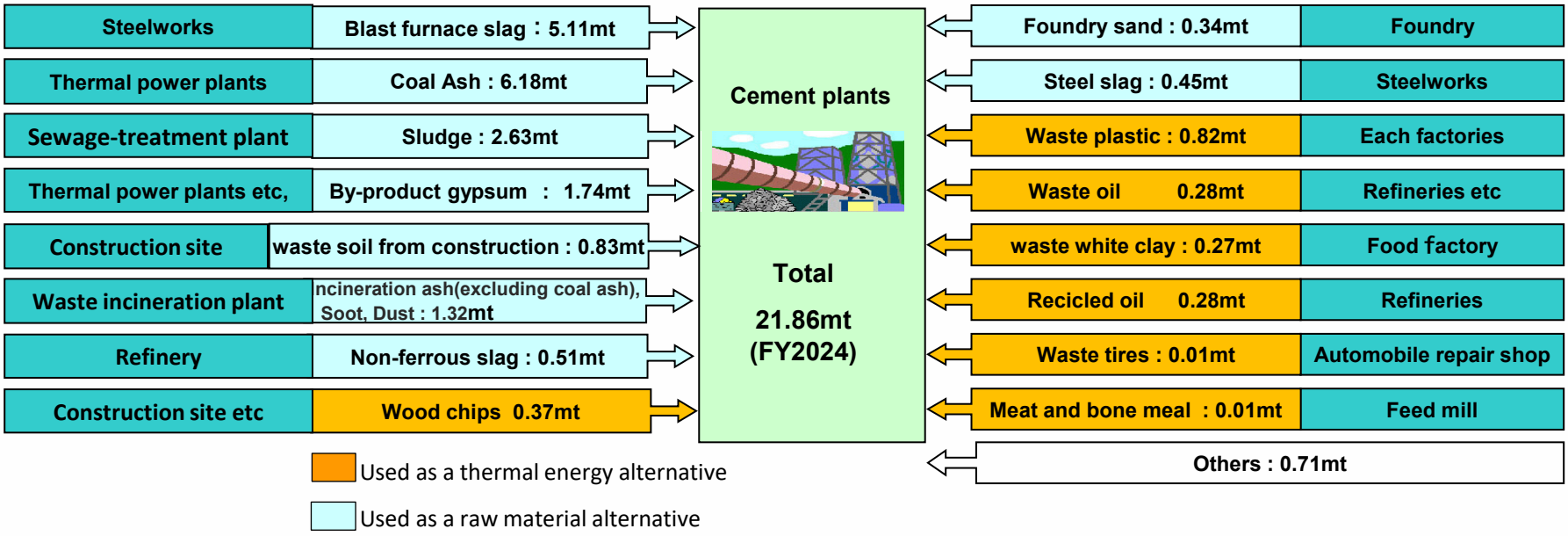
(Next: continued to(2))

***Alternative Fuels and Raw Materials**



Various raw materials:

Primal constituents of cement clinker are CaO, SiO_2, Al_2O_3 and Fe_2O_3. The raw materials consist of limestone, clay, silica stones, iron oxide and the others. Since a lot of waste materials and by-products are composed of primal constituents of cement clinker, these are used effectively as some materials.



Japan's cement industry uses waste and by-products from various industries and local governments as raw materials for cement and as alternative energy sources.

478 kg per ton of cement

Source: Investigation by JCA

Utilizing waste as AFRMs (2)

Disasters and their disaster wastes utilized for cement production since 2004		
Date	Type of Disaster (Location)	Main Disaster Wastes
2004 Oct.	Earthquake (Niigata-Chuetsu)	Wood chips
2007 Mar.	Earthquake (Noto peninsula)	Wood chips
2007 Jul .	Earthquake (off the coast of Chuetsu)	Wood chips
2011 Mar.	Great East Japan Earthquake	Wood chips, Mixed disaster debris etc.
2014 Aug.	Sediment disaster due to heavy rain (Hiroshima)	Wood chips
2015 Sep.	Heavy rain and flood (Kanto/ Tohoku area)	Tatami mat
2015 Sep.	JCA joined in the D.Waste-Net (Disaster Waste Treatment Support Network) managed by the Ministry of the Environment	
2016 Apr.	Earthquake (Kumamoto)	Wood chips, Tiles, Mixed disaster debris
2016 Dec.	Large-scale fire (Itoigawa city)	Fire wastes
2017 Jul.	Heavy rain and flood (northern Kyushu)	Wood chips, Tiles, Mixed disaster debris
2018 Jul.	Heavy rain and flood (western Japan)	Sediment, Sludge, Wood chips
2019 Apr.	Heavy rain and flood (northern Kyushu)	Sludge
2019 Oct.	Heavy rain and flood due to the Typhoon (Eastern Japan)	Sediment, Rice straw, Wood chips
2020 Jul.	Heavy rain and flood (Honsyu/Kyushu)	Tatami mat, Wood chips
Total amount of treatment (2004~2020)		1.63million tonnes

Examples of the disaster wastes

Left: Rice straw mixed with sediment

Right: Tatami mats wet with muddy water

Source: JCA English homepage https://www.jcassoc.or.jp/cement/2eng/e_01b.html

Thank you for your attention.

If you need further assistance,

approach me（below address） without hesitation.

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